



# PATENT SPECIFICATION

597,228

No. 24638/44.

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## PROVISIONAL SPECIFICATION

### Improvements in or relating to Reciprocating Pumps for Use in Hydraulic Transmission of Power

I, AUGUSTUS GEORGE CHAMBERLAIN, a British Subject, of 10, Broadlands Road, Highgate, London, N.6, do hereby declare the nature of this invention to be as follows:—

The subject of this invention is a multi-stage pumping unit, especially applicable for bending tubes, but also capable of use for other purposes.

According to the invention high and low pressure systems are operated simultaneously until a predetermined pressure is reached, after which only the high pressure piston or pistons continue in operation.

In an exemplification of the invention a mainly tubular ram is arranged to work in a cylinder which is surrounded by a concentric oil reservoir, and is advanced by hydraulic pressure set up by pistons actuated by means of a manually operated or power operated lever without any undue stress on the part of the operator and without the aid of extension levers, springs being provided to return the ram after completion of its stroke. The ram cylinder communicates with the cylinders in which work pistons adapted to be operated respectively at a relatively low pressure and at a higher pressure. These pistons will continue sucking oil from the reservoir and pumping it into the ram cylinder until a predetermined

pressure is built up. A passage leading from the interior of the low pressure cylinder to the oil reservoir is controlled by a spring loaded ball valve, the spring pressure on which is adjusted by means of a screw threaded plug. When the requisite pressure is obtained, a plunger exposed to the pressure in the ram cylinder pushes the ball valve off its seat, allowing oil to pass from the low pressure cylinder to the oil reservoir. The high pressure piston is then the only one supplying oil under pressure to force the ram forward.

By the use of the apparatus just described, contact is made quickly between the ram and the work-piece by the aid of the low pressure system, and at a certain value of the pressure the low pressure system ceases to be operative whilst the work is continued by the high pressure system. Immediately the pressure drops or is released, the ball valve returns to its normal position, allowing both systems to be operative to move the ram quickly up to its work again.

Dated this 8th day of December, 1944.

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## COMPLETE SPECIFICATION

### Improvements in or relating to Reciprocating Pumps for Use in Hydraulic Transmission of Power

I, AUGUSTUS GEORGE CHAMBERLAIN, a British Subject, of 10, Broadlands Road, Highgate, London, N.6, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to reciprocating pumps for use in hydraulic transmission of power, and is especially applicable for bending tubes, but also capable of use for other purposes. The apparatus I employ

is of the kind in which high and low pressure pistons in parallel arrangement are arranged to be manually operated simultaneously until a predetermined pressure is reached, after which the low pressure piston automatically ceases to operate, only the high pressure piston continuing to deliver.

According to the invention a ram is arranged to work in a cylinder encircled by a concentric oil reservoir, from which reservoir oil is pumped into the said

cylinder by high and low pressure pistons or plungers operated by a lever to advance the said ram by oil pressure until a predetermined pressure is built up in the ram cylinder and causes the opening of an  
5 adjustably spring loaded valve to conduct the oil discharged from the low pressure cylinder back to the oil reservoir.

In order that the said invention may be more clearly understood and readily  
10 carried into effect the same will now be more fully described with reference to an exemplification thereof illustrated in the accompanying drawings, wherein:—

15 Figure 1 represents in central vertical section a two-stage hydraulic bending machine.

Figure 2 represents a cross section taken on the line II—II in Figure 1.

20 Figure 3 represents a fragmentary cross section taken on the line III—III in Figure 2, through the low pressure cylinder, the inlet and outlet valves on the high pressure side being similar.

25 Figure 4 is a cross section on the line IV—IV in Figure 1.

Figure 5 is a horizontal section taken on the line V—V in Figure 4.

30 Figure 6 is a horizontal section taken on the line VI—VI in Figure 4.

In the drawings, 10 indicates the main body of the tool, 11 a cylinder surrounded by a concentric oil reservoir 12, in which  
35 cylinder a mainly tubular ram 13 is arranged to work. One or more packing rings 14 are secured by a gland nut 15 between the ram 13 and the cylinder 11, and a felt washer 17 is tightened in a spacing ring 16 on the end of the reservoir 12 by a nut 18. A manually operated  
40 lever 19 is pivoted on a pin 20 in a bracket 21 on the said main body 10, the said lever terminating in a pressure piece 22. Pistons or plungers 23 and 24 can be  
45 actuated by a bearing cap 25 on the said pressure piece, against the resistance of springs 27 and 28, the plunger 23 being a low pressure plunger and the plunger 24 a relatively high pressure plunger, the  
50 operation of which is hereinafter described, to force the ram 13 to the left against the resistance of the ram return spring 29.

By the action of the pumping handle 19  
55 pressure is built up in the ram cylinder 11 by the plungers 23 and 24 sucking oil from the reservoir 12 and pumping it into the cylinder 11 simultaneously until the pressure in the said cylinder acting on  
60 the small plunger 31 is sufficient to force the adjustably spring loaded ball valve 32 off its seat, this allowing the oil supplied by the low pressure plunger 23 to be returned to the oil reservoir 12,  
65 through the passage 33, so that as long as

the pressure in the cylinder 11 is maintained at a sufficiently high value to keep the ball 32 off its seat, only the high pressure plunger 24 supplies oil under pressure to the ram cylinder 11.

70 A filler cock and air release valve is shown at 34 and a ball valve at 36 (Figure 5). The ball 36 in conjunction with its spindle and operating knob acts as control valve to the bending machine  
75 hydraulic circuit. When clamped down against its seating, as shown in Figure 5, the valve is in the "on" position, whilst when released, oil pressure forces the ball off its seating, allowing the oil to return  
80 to the reservoir, i.e. the "off" position.

A tube or rod to be bent can be secured in any suitable framework to be opposed to the ram.

By the use of the apparatus just  
85 described, contact is made quickly between the ram and the work-piece by the aid of the low pressure system, and at a predetermined pressure the low pressure system ceases to be operative whilst the  
90 work is continued by the high pressure system. Immediately the pressure drops or is released, the ball valve returns to its normal position, allowing both systems to be operative to move the ram quickly  
95 up to its work again.

In the prior Patent Specification No. 371,877 weighted lever trip mechanism was proposed, which in the present invention is replaced by a spring-loaded valve.  
100 In Specification No. 497,546 was described a compound pump circuit including a plurality of positive displacement radial plunger pumps, whereas the present invention relates to a single hand operated  
105 plunger pump having high and low pressure pistons. Specification No. 546,420 describes the combination of a low pressure pump, a high pressure pump of less volumetric capacity having its inlet connected to the delivery side of the low pressure pump, an operating mechanism  
110 common to both pumps into which the low pressure pump delivers through a non-return valve, and a hand operated  
115 valve for by-passing the low pressure pump, having high and low pressure cylinders on the same centre line, as compared with the parallel arrangement of the present invention. Specification No. 120  
562,368 describes two pumps, each of the double-acting differential piston type, one pump being cut out when the pressure in the hydraulic circuit rises to a predetermined value. Specification No. 125  
348,691 describes a system in which high and low pressure spring loaded pistons of differing diameters work in parallel cylinders. United States Patent Specification No. 1,899,678 relates to hydraulic  
130

presses, and depends on sources of high and low fluid pressure connected with a main and auxiliary cylinder respectively. The present invention is distinguished from these proposals by the following claims.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A manually operated reciprocating pump for use in hydraulic transmission of power of the kind in which high and low pressure pistons in parallel arrangement are arranged to be operated simultaneously until a predetermined pressure is reached, after which the low pressure system automatically ceases to operate, only the high pressure piston continuing to deliver, characterised in that a ram is arranged to work in a cylinder encircled

by a concentric oil reservoir, from which reservoir oil is pumped into the said cylinder by high and low pressure pistons or plungers operated by a lever to advance the said ram by oil pressure until a predetermined pressure is built up in the ram cylinder and causes the opening of an adjustably spring loaded valve to conduct the oil discharged from the low pressure cylinder back to the oil reservoir.

2. A high and low pressure pumping unit having its parts constructed, arranged, and adapted to operate substantially as hereinbefore described with reference to the accompanying drawings.

Dated this 5th day of December, 1945.

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[This Drawing is a reproduction of the Original on a reduced scale.]

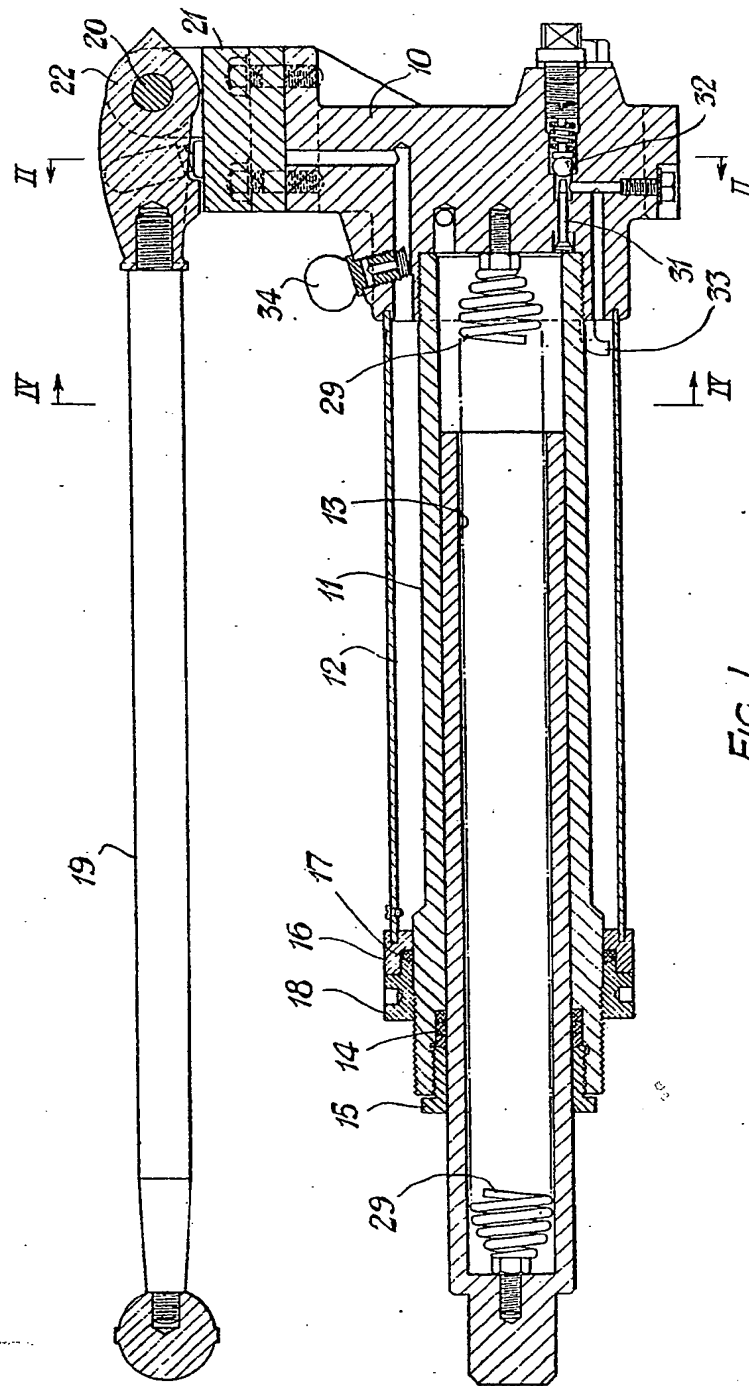
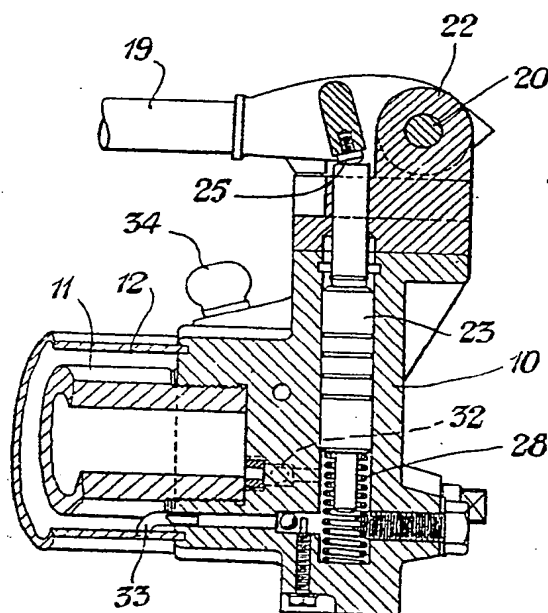
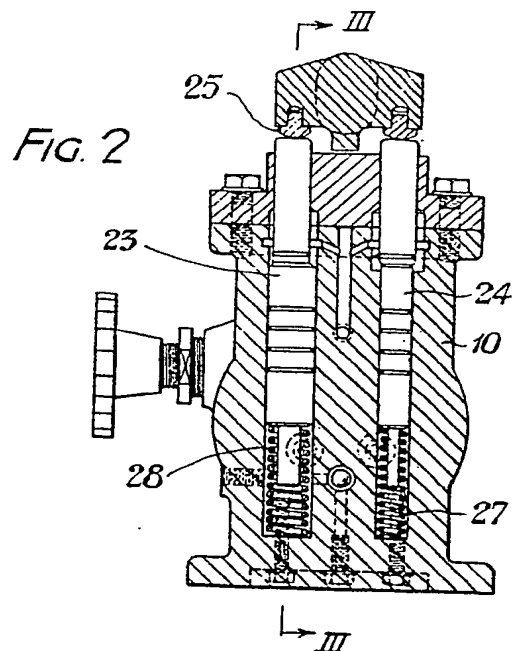


FIG. 1.

H.M.S.O. (Ty.P.)

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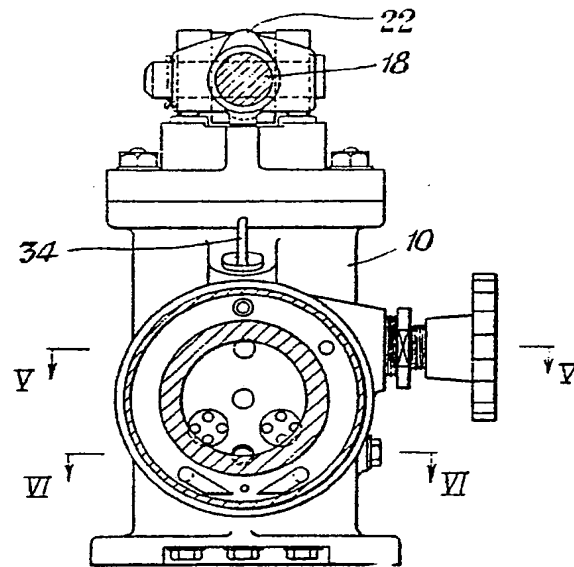


FIG. 4.

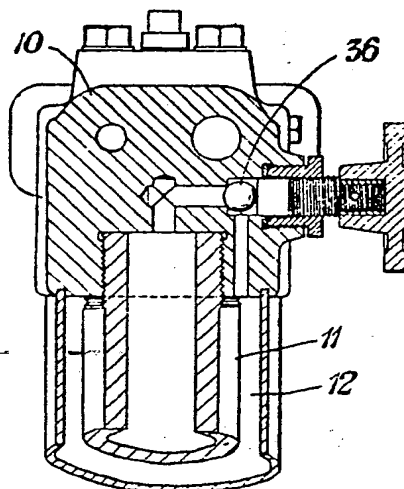


FIG. 5.

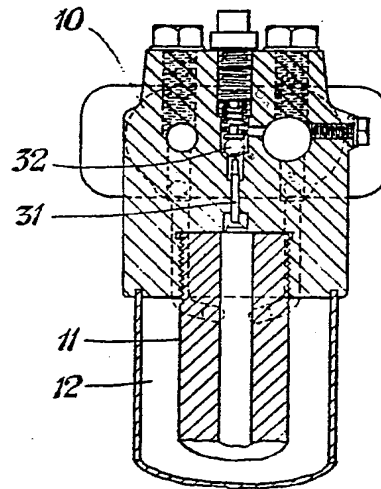


FIG. 6.

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SHEET 2

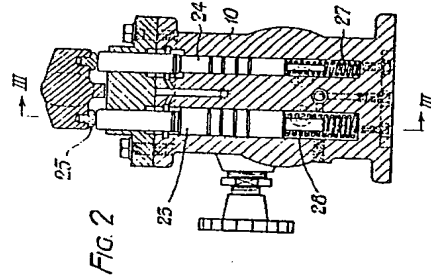


Fig. 2

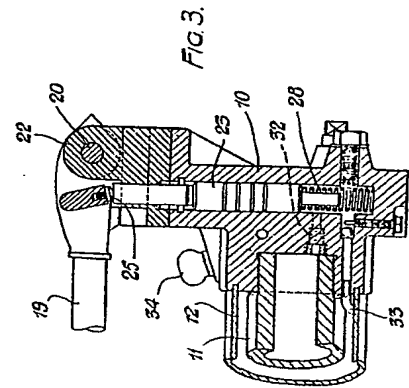


Fig. 3

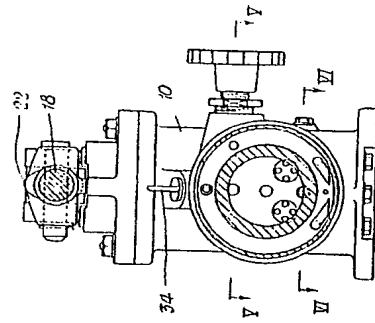


Fig. 4

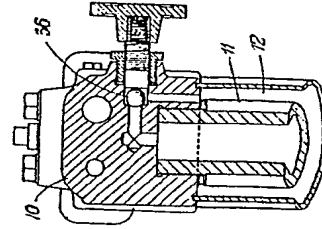


Fig. 5

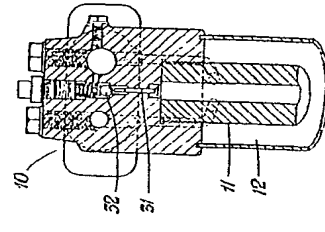


Fig. 6

3 SHEETS  
SHEET 3

4,105,017 (1978)

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